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<b>(21) International Application Number:</b> PCT/US99/20954 <b>(22) International Filing Date:</b> 14 September 1999 (14.09.99)  <b>(30) Priority Data:</b> 60/100,457 15 September 1998 (15.09.98) US  <b>(71)(72) Applicant and Inventor:</b> BATES, Jack, H. [US/US]; 27812 Clear Lake Road, Eugene, OR 97402 (US).  <b>(74) Agent:</b> ADAMSON, Steven, J.; P.O. Box 1909, Eugene, OR 97440 (US).		<b>(81) Designated States:</b> AU, NZ, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
<b>(54) Title:</b> PERSISTENT DIATOMACEOUS EARTH MOLLUSKICIDIAL COMPOSITION  <b>(57) Abstract</b>  Compositions for the control of mollusks and other organisms and of making the compositions. The compositions preferably include diatomaceous earth (DE), a pest attracting bait and an agent that combines the DE and bait to enhance persistence under typical environmental conditions. Baits include, but are not limited to, natural, renewable products such as seed meal, pomace and other grain, fruit or vegetable processing byproducts. Mixing of the DE and bait with an oil, and then forming pellets or granules, etc., is also disclosed.		

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PERSISTENT DIATOMACEOUS EARTH  
MOLLUSKICIDIAL COMPOSITION

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CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 60/100,457, filed September 15, 1998, and having the same title and inventor(s) as above.

FIELD OF THE INVENTION

The present invention relates to a composition of natural ingredients that form a pesticide (hence a "natural pesticide") that is effective against mollusks such as snails and slugs, amongst other pests. More specifically, the present invention relates to a natural pesticide that exhibits persistence when exposed to environmental conditions.

BACKGROUND OF THE INVENTION

The present invention uses diatomaceous earth (hereinafter referred to as "DE") as a killing agent. DE is known in the art for this purpose. Examples of products and patents that disclose the use of DE include U.S. Patent number 4,729,895, issued to Carle for an Insecticidal Natural Bait Composition and Method of Using Same; U.S. Patent number 5,773,017, issued to Korunic et al. for a Diatomaceous Earth Insecticidal Composition; and a product called Crawling Insect Killer produced by SureFire Products and distributed by Consep, Inc., of Bend, OR. Some of these patents or products

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combine DE with a particular insect bait. For example, the patent of Carle discloses the use of sugars such as lumolinine (an inverted sugar) or the like as a bait.

While these products have provided some benefit  
5 towards their intended purpose, they also have disadvantageous aspects. One disadvantageous aspect is that the compositions lack persistence under normal environmental conditions. Persistence as used herein refers to the ability of a composition to withstand the  
10 degradative and dispersal effects of environmental conditions such as wind, rain, dew, snow, etc. The above mentioned prior art compositions are provided in a powder or dust form and thus when used externally (i.e., placed in a garden or the like) are blown away by wind and  
15 washed away by rain and/or lawn sprinklers, etc. Accordingly, these compositions are only applicable to interior use, such as in a closed grain elevator, or when wind or moisture is not present.

Another disadvantageous aspect of present DE  
20 compositions is that they utilize baits that are undesirably expensive. A need exists for a suitable bait or delivery agent that may be economically obtained and integrated with the other components of a DE composition.

With respect to currently available slug and snail  
25 products, some products use metaldehydes as their active ingredient. While effective to some extent, these products are disadvantageous in that metaldehyde is a known toxin.

30

#### SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a natural pesticide that exhibits persistence in the presence of environmental conditions.

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It is another object of the present invention to provide a natural pesticide that utilizes economical and widely available material as bait.

It is another object of the present invention to  
5 provide a natural pesticide that is pelletized or granulized or otherwise processed to enhance persistence.

It is another object of the present invention to provide a natural pesticide that utilizes a grain, fruit or vegetable processing byproduct such as corn gluten  
10 meal or wheat gluten meal or the like.

It is another object of the present invention to provide a natural pesticide with persistence that is effective against mollusks such as snails and slugs.

And it is also an object of the present invention to  
15 provide such a pesticide that is safe for dogs, cats and wildlife (including fish and birds), amongst other animals.

These and related objects of the present invention are achieved by use of a persistent DE molluskicidal  
20 composition as described herein.

The attainment of the foregoing and related advantages and features of the invention should be more readily apparent to those skilled in the art, after review of the following more detailed description of the  
25 invention taken together with the drawings.

#### DETAILED DESCRIPTION

The present invention combines a DE and a bait for a desired pest, and this combination is processed in such a  
30 manner as to enhance persistence.

DE, as alluded to above, is known as a naturally occurring dust that is effective against insects. DE develops generally as follows. Single-celled plants

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called diatoms live in seas and lakes and extract silicon from water into their shells producing a hydrated amorphous silica skeleton. When the diatoms die, the tiny shells sink and in some instances these shells can build up into thick layers. Eventually the shells of these deposits become fossilized and compressed into a soft, chalky rock that is called DE. DE is prepared for commercial use by quarrying, drying and milling. Changes to diatomaceous earth in this process include reduction of moisture content and mean particle size. DE in this form is available commercially.

DE is also referred to as amorphous silicon dioxide (by the U.S.E.P.A.), diatomaceous silica and diatomite, amongst other names. DE is non-carcinogenic and non-toxic to mammals and is "Generally Regarded as Safe" (GRAS).

The particular bait used in conjunction with DE may depend to some extent on the pest to which the composition is directed. Empirical evidence has and will show a connection between certain baits and their targeted pests, while other baits will have a more general scope of application. Suitable baits include those that demonstrate efficacy with insects or mollusks or a sub-class of insects or mollusks or with another pest.

In a preferred embodiment of the present invention, a grain, fruit or vegetable processing byproduct is used as a bait. These processing byproducts are used for many reasons including (1) they have been shown to attract mollusks such as slugs and snails and some insects, (2) they are non-toxic and otherwise environmentally friendly, (3) they are widely available (given the amount of grain and produce processed in this country), (4) they

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are relatively inexpensive, (5) they occur naturally and (6) they tend to expand in the stomachs of pests (particularly grain byproducts), causing an increased kill rate due to bloating. The selected grain or produce  
5 byproduct may be, but is not limited to, grape or apple pomace, corn gluten, wheat gluten, beet pulp, oat mill run, etc.

In a further preferred embodiment, the bait is a corn processing byproduct and more specifically corn  
10 gluten meal (hereinafter referred to as "CGM"). CGM is a commercially available material extracted from corn meal. It is commercially available from many sources such as Grain Processing Corporation of Muscatine, Iowa. Generally, corn gluten meal is made by drying the liquid  
15 gluten stream separated from corn during corn wheat milling processing. While its composition may vary it commonly contains about sixty percent protein which is rich in xanthophylls. It is a mixture of protein, lipid, carbohydrate and ash material. While corn gluten meal is  
20 known, in the past its primary usage has been as a feed substance for use with boiler chickens, etc., and as a pre-emergent weed suppressor and nitrogen fertilizer.

To enhance or increase the persistence of the DE and a selected bait (or suitable filler material), these  
25 components are preferably processed in a manner that increases a binding force between them and thus improves their combined structural integrity. One suitable process is pelletizing. Another suitable process is granulizing.

30 In a preferred embodiment, a vegetable oil or like substance is combined with the DE and bait, and this composition is mixed and extruded under pressure to produce pellets. Related pelletizing processes are known

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and include those used to make animal feeds. A preferred oil is soybean oil, although other oils or like substances may be used. Criteria for the selected oil substance include that the oil substance (1) offer lubrication, for example, to prevent the CGM or other bait from clogging the pelletizing machinery and (2) provide sufficient binding of the DE to the bait to enhance persistence.

The pelletized DE and bait composition deteriorates relatively slowly under normal environmental conditions providing a slow release of DE for the location where the pellets are placed. This manner of gradual deterioration creates a persistent presence of DE that is ideal for controlling slugs and snails (and other pests) in a garden and like environment. It should be recognized that the rate of deterioration can be altered by modifying the concentrations of starting ingredients and the amount of pressure used to form the pellets.

#### EXAMPLE I

In a first example of a fabrication process, the following steps and ratios produce 2,230 pounds of composition.

##### Starting materials:

2,000 lbs. CGM  
200 lbs. DE (amorphous SiO<sub>2</sub>)  
30 lbs. soybean oil

The starting materials are weighed electronically and the oil is manually added to the CGM and DE. The composition is mixed for approximately 10-20 minutes in an industrial mixer and extruded under pressure in a standard pelletizing machine. CGM is the largest component by weight and the least expensive.



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Pellets formed in this manner were distributed at various locations in western Oregon (around shrubbery and gardens, etc.) and shown to have significant efficacy (approximately 100%) against slugs and snails. Killing  
5 appeared to come directly from DE ingestion and from bloating caused by hydrating CGM ingested by the slug or snail. Persistence ranged from approximately 2 weeks to 10 weeks based on ambient moisture levels.

## 10 EXAMPLE II

In place of CGM in Example I, other baits can be utilized. These include any suitable grain or produce byproduct as alluded to above or any other suitable bait. Non-grain or non-produce byproducts could also be used,  
15 however, it is preferred that the bait be non-toxic and environmentally friendly. The concentration of bait to other components may vary for a different bait and appropriate concentrations can be developed empirically.

## 20 EXAMPLE III

In place of soybean oil in Example I, other vegetable oil, such as Canola and Cotton Seed oil and the like, could be utilized. Petroleum oils could also be utilized though they may not be sufficiently attractive  
25 to target pests, and the use of petroleum oils may have an adverse environmental impact.

The concentration of a substitute oil and of the other components may differ from those given above when a substitute oil is utilized. Appropriate concentration  
30 can be determined appropriately.

## EXAMPLE IV

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With respect to target organisms, the composition of the present invention may be effective against non-mollusk organisms such as cockroaches, sow bugs, silverfish and ear wigs. Efficacy against these pests may depend on exposure conditions. In granular form or in a deteriorated pellet condition, the present compositions may be more effective against these and related pests because the compositions are available in smaller, more easy-to-eat sizes. Similarly, the pellets described in Example I can be made in different sizes to accommodate different pests.

## EXAMPLE V

Compositions of the present invention may be granulized by one or more of the following methods. A first method is to extrude the mixed composition through smaller sized orifices to produce smaller and more fragile pieces. The ratios of oil, diatomaceous earth and bait may need to be altered as orifice size is altered.

A second method is to crush pellets.

A third method is to spread the mixed composition in a thin layer and let it dry. The dried layer may then be cracked to form granules.

While the invention has been described in connection with specific embodiments thereof, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features

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hereinbefore set forth, and as fall within the scope of the invention and the limits of the appended claims.

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CLAIMS

1. A composition for use in control of mollusks and other organisms, comprising:
  - diatomaceous earth;
  - 5 a pest attracting bait; and
  - a combining agent that enhances the persistence of the diatomaceous earth and bait under environmental conditions.
- 10 2. The composition of claim 1, wherein said bait consists of one or more natural, renewable products.
3. The composition of claim 2, wherein said bait includes at least one natural product from the group of  
15 natural products including seedmeal, pomace or another grain, fruit or vegetable processing byproduct.
4. The composition of claim 2, wherein said at least one natural product is corn gluten meal.  
20
5. The composition of claim 1, wherein said combining agent includes oil.
6. The composition of claim 5, wherein said oil  
25 includes a vegetable oil.
7. The composition of claim 5, wherein said oil includes one or more of the group of oils including canola oil, soybean oil and cottonseed oil.  
30
8. The composition of claim 1, wherein said composition is at least 50% bait by weight.

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9. A composition for use in control of mollusks and other organisms, comprising:

diatomaceous earth;

a pest attracting bait comprised of one or more  
5 natural products; and

a combining agent that enhances the persistence of the diatomaceous earth and bait under environmental conditions.

10 10. The composition of claim 9, wherein said bait includes at least one natural product from the group of natural products including seedmeal, pumice or another grain, fruit or vegetable processing byproduct.

15 11. The composition of claim 9, wherein said combining agent includes oil.

12. The composition of claim 11, wherein said oil includes a vegetable oil.

20

13. The composition of claim 9, wherein said composition is at least 50% bait by weight.

14. A method of making a composition for use in control  
25 of mollusks and other organisms, comprising the steps of:

providing diatomaceous earth;

providing a pest attracting bait;

providing a combining agent;

30 mixing said diatomaceous earth, bait and combining agent; and

applying pressure to the mixture to form solid units each including diatomaceous earth, bait and combining agent.

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15. The method of claim 14, further comprising the step of forming said solid units to be pellets. —

5 16. The method of claim 14, further comprising the step of forming said solid units to be granules.

17. The method of claim 14, wherein said bait providing step includes the step of providing a bait comprised of  
10 one or more natural products.

18. The method of claim 14, wherein said combining agent providing step includes the step of providing an oil as said combining agent.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99/20954

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : A01N 25/08, 25/12, 25/14, 31/14, 31/02

US CL : 424/405, 408, 409, 410, 538; 514/778, 536/103

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 424/405, 408, 409, 410, 538; 514/778, 536/103

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WEST, CAS ONLINE, MEDLINE, SCISEARCH, BIOSIS, FAO, WPIDS

search terms: diatomaceous earth, diatomaceous silica, oil, corn gluten meal, mollusks, bait, insecticides, vegetable oil

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ---- Y	US 5,096,710 A (MINAGAWA et al) 17 March 1992(17/03/92), abstract and claims 1-2, 20, 25, 33 and 35.	1-13 ----- 14-18
Y	Database DERWENT, CA 1112158 A1, CARLE, A., 'Insecticidal bait contg. humidified diatomaceous silica - and sugar or sugar substitute,' abstract, 10 November 1981.	1, 9, 14
Y	JP 48080723 A2 (SAGAWA et al.) 29 October 1973(29/10/73), abstract.	1-18
Y	Database DERWENT, AU 9474469 A, THOMAS, I.D., 'Repellent for molluscs or other garden pests - comprises a water-adsorbent mineral material such as montmorillonite or kaolin,' abstract, 27 April 1995.	1-18

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US 5883262 A (SHUTO et al.) 16 March 1999(16/03/99), see column 16.	1-18

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